Claims

Claim 1. An automated system for tracking the movement of multiple objects within a predefined area comprising:

a fixed area tracking matrix for first detecting the motion of each object in (X, Y) space;

a first algorithm operated on a computer system responsive to the fixed area tracking matrix for determining the (X, Y) location of each object;

a movable volume tracking matrix responsive to the determined (X, Y) locations for controllably detecting the motion of each object in (X, Y, Z) space; and

a second algorithm operated on the computer system responsive to the movable volume tracking matrix for determining the (X, Y, Z) dimensional characteristics of each object and for forming a database representative of each object's locations, movements and dimensional characteristics.

Claim 2. The system of claim 1 further comprising:

one or more energy sources emitting non-visible energy that is detected by both the area and volume tracking matrices;

flat, visibly transparent markers adhered onto multiple locations on each object that reflect the non-visible energy; and

a third algorithm operated on the computer system responsive to the non-visible energy reflected off the markers for forming a database of related coordinates of each marker on each object.

Claim 3. The system of claim 1, wherein the objects are additionally identified, further comprising:

one or more energy sources emitting non-visible energy;

at least one flat, visibly transparent uniquely encoded marker adhered onto the top surface of each object that reflects the non-visible energy for detection by both the area and volume tracking matrices; and

a third algorithm operated on the computer system and responsive to the reflections off the at least one encoded marker detected by the area and volume tracking matrices for including into the database each object's identity along with its locations, movements, and dimensional characteristics.

Claim 4. The system of claim 1, wherein the objects are first identified and tracked in an outer area that is adjoining the predefined area and subsequently tracked as they enter and move about within the predefined area, further comprising:

one or more energy sources emitting non-visible energy throughout both the outer and predefined areas;

one unique marker or set of markers adhered onto each object that reflects the non-visible energy for detection by both the area and volume tracking matrices;

one or more outer area cameras set up to view the outer area responsive to the non-visible energy;

a third algorithm operated on the computer system responsive to the reflections off the unique marker or set of markers detected by the outer area cameras for forming a first database including the identity of each object as well as the object's changing location especially as the object enters the predefined area; and

a fourth algorithm operated on the computer system responsive to the area and volume tracking matrices modified to update the first database of object identity and changing location from the outer area to include additional changing location information based upon each object's movements in the predefined area.

Claim 5. The system of claim 1 further comprising:

one or more energy sources emitting visible energy that is detected by both the area and volume tracking matrices;

spherical markers adhered onto multiple locations on each object that reflect the visible energy; and

a third algorithm operated on the computer system responsive to the visible energy reflected off the markers for forming a database of related coordinates of each marker on each object.

Claim 6. The system of claim 1 further comprising:

one or more energy sources emitting non-visible energy that is detected by both the area and volume tracking matrices;

spherical markers adhered onto multiple locations on each object that reflect the non-visible energy; and

a third algorithm operated on the computer system responsive to the non-visible energy reflected off the markers for forming a database of related coordinates of each marker on each object.

Claim 7. An automated system for tracking the movement of multiple objects within a predefined area comprising:

one or more energy sources emitting non-visible energy;

flat, visibly transparent markers adhered onto multiple locations of each object that reflect the non-visible energy;

one or more cameras responsive to the reflected non-visible energy; and

a computer system responsive to the one or more cameras for forming a database of related coordinates of each marker on each object.

Claim 8. The system of claim 7 further comprising:

a fixed area tracking matrix for first detecting the motion of each object in (X, Y) space, wherein the computer system is responsive to the fixed area tracking matrix for determining the (X, Y) location of each object; and

a movable volume tracking matrix responsive to the determined (X, Y) locations for controllably detecting the motion of each object in (X, Y, Z) space, wherein the computer system is responsive to the movable volume tracking matrix for forming a database of related coordinates of each marker on each object.

Claim 9. The system of claim 7, wherein the objects are additionally identified, further comprising at least one flat, visibly transparent uniquely encoded marker adhered onto the top surface of each object that reflects the non-visible energy, and wherein the computer system is responsive to the reflections off the at least one encoded marker for including into the database each object's identity along with the related coordinates of each marker on each object.

Claim 10. The system of claim 7, wherein the objects are first identified and tracked in an outer area that is adjoining the predefined area and subsequently tracked as they enter and move about within the predefined area, further comprising:

at least one energy source emitting non-visible energy throughout the outer area;

one unique marker or set of markers adhered onto each object that reflects the non-visible energy; and

one or more outer area cameras set up to view the outer area that detect the non-visible energy, wherein the computer system is responsive to the reflections off the unique marker or set of markers detected by the outer area cameras for forming a second database including the identity of each object as well as the object's changing location especially as the object enters the predefined area, and

the computer system updates the second database of object identity and changing location from the outer area to include additional related coordinates of each marker on each object from the predefined area.

Claim 11. An automated system for identifying multiple objects within a predefined area comprising:

one or more energy sources emitting non-visible energy;

at least one flat, visibly transparent uniquely encoded marker adhered onto the top surface of each object that reflects the non-visible energy;

one or more cameras responsive to the reflected non-visible energy; and

a computer system responsive to the one or more cameras for forming a database of identities of each object.

Claim 12. The system of claim 11 further comprising:

a fixed area tracking matrix for first detecting the motion of each object in (X, Y) space, wherein the computer system is responsive to the fixed area tracking matrix for determining the (X, Y) location of each object; and

a movable volume tracking matrix responsive to the determined (X, Y) locations for controllably detecting the motion of each object in (X, Y, Z) space, wherein the computer system is responsive to the movable volume tracking matrix for determining the (X, Y, Z) dimensional characteristics of each object and for forming a database representative of each object's movements and dimensional characteristics and associating these with the existing identities of each object.

Claim 13. The system of claim 11, wherein the objects are additionally tracked, further comprising flat, visibly transparent markers adhered onto multiple locations of each object that reflect the non-visible energy, wherein the computer system is responsive to the reflections off the flat markers, forms a database of related coordinates of each marker on each object, and associates these coordinates with the existing identities of each object.

Claim 14. The system of claim 11, wherein the objects are first identified and tracked in an outer area that is adjoining the predefined area and subsequently tracked as they enter and move about within the predefined area, further comprising:

one or more energy sources emitting non-visible energy throughout the outer area for reflection off the at least one unique marker; and

one or more outer area cameras set up to view the outer area responsive to the non-visible energy emitted throughout the outer area and reflected off the at least one unique marker, wherein the computer system is responsive to the reflections off the at least one unique marker detected by the outer area cameras for forming a second database including the identity of each object as well as the object's changing location especially as the object enters the predefined area, wherein

the computer system updates the second database of object identity and changing location from the outer area to include additional changing location information of each encoded marker from the predefined area.

Claim 15. An automated system for first identifying and tracking multiple objects in an outer area that is adjoining a predefined area and subsequently tracking those objects as they enter and move about within the predefined area, the system comprising:

one or more energy sources emitting non-visible energy throughout both the outer and predefined areas;

one unique marker or set of markers adhered onto each object that reflects the non-visible energy;

one or more outer area cameras responsive to the non-visible energy reflected off the markers while the objects are within the outer area;

one or more predefined area cameras responsive to the non-visible energy reflected off the markers while the objects are within the predefined area;

a first algorithm operated on a computer system responsive to the outer area cameras for forming a database including the identity of each object as well as the object's changing location especially as the object enters the predefined area; and

a second algorithm operated on the computer system responsive to the predefined area cameras for updating the existing database of object identity and changing location from the outer area to include additional changing location information based upon the object movements in the predefined area.

Claim 16. The system of claim 15 further comprising:

a fixed area tracking matrix for first detecting the motion of each object in (X, Y) space, wherein the computer system is responsive to the fixed area tracking matrix for determining the (X, Y) location of each object; and

a movable volume tracking matrix responsive to the determined (X, Y) locations for controllably detecting the motion of each object in (X, Y, Z) space.

Claim 17. The system of claim 15, wherein the objects are additionally tracked, further comprising flat, visibly transparent markers adhered onto multiple locations of each object that reflect the non-visible energy, wherein the computer system is responsive to the reflections off the flat markers, forms a database of related coordinates of each marker on each object, and associates these coordinates with the existing identities of each object.

Claim 18. The system of claim 15 wherein the one unique marker or set of markers further comprises at least one flat, visibly transparent uniquely encoded marker adhered onto the top surface of each object that reflects the non-visible energy.

Claim 19. An automated system for tracking the movement of multiple objects within a predefined area comprising:

one or more energy sources emitting visible energy;

flat markers adhered onto multiple locations of each object that reflect the visible energy;

a multiplicity of cameras responsive to the reflected visible energy; and

a computer system responsive to the multiplicity of cameras for forming a database of related coordinates of each marker on each object.

Claim 20. The system of claim 19 wherein the multiplicity of cameras comprises at least two fixed volume tracking cameras with at least partially overlapping fields-of-view for detecting the motion of each marker in (X, Y, Z) space.

Claim 21. The system of claim 20 wherein the multiplicity of cameras forms an ever larger total field-of-view by adding additional sets of two or more fixed volume tracking cameras whose individual fields-of-view partially overlap each other covering new volume space and partially overlap existing cameras.

Claim 22. An automated system for tracking the movement of multiple objects within a predefined area comprising:

one or more energy sources emitting non-visible energy;

flat markers adhered onto multiple locations of each object that reflect the non-visible energy;

a multiplicity of cameras responsive to the reflected non-visible energy; and

a computer system responsive to the multiplicity of cameras for forming a database of related coordinates of each marker on each object.

Claim 23. The system of claim 22 wherein the multiplicity of cameras comprises at least two fixed volume tracking cameras with at least partially overlapping fields-of-view for detecting the motion of each marker in (X, Y, Z) space.

Claim 24. The system of claim 23 wherein the multiplicity of cameras forms an ever larger total field-of-view by adding additional sets of two or more fixed

volume tracking cameras whose individual fields-of-view partially overlap each other covering new volume space and partially overlap existing cameras.

Claim 25. An automated system for identifying multiple objects within a predefined area comprising:

one or more energy sources emitting visible energy;

at least one uniquely encoded marker adhered onto the top surface of each object that reflects the visible energy;

a multiplicity of cameras responsive to the reflected visible energy; and

a computer system responsive to the multiplicity of cameras for forming a database of identities of each object.

Claim 26. The system of claim 25 wherein the multiplicity of cameras comprises at least two fixed volume tracking cameras with at least partially overlapping fields-of-view for detecting the motion of each marker in (X, Y, Z) space.

Claim 27. The system of claim 26 wherein the multiplicity of cameras forms an ever larger total field-of-view by adding additional sets of two or more fixed volume tracking cameras whose individual fields-of-view partially overlap each other covering new volume space and partially overlap existing cameras.

Claim 28. An automated system for identifying multiple objects within a predefined area comprising:

one or more energy sources emitting non-visible energy;

at least one uniquely encoded marker adhered onto the top surface of each object that also reflects the non-visible energy;

a multiplicity of cameras responsive to the reflected non-visible energy; and

a computer system responsive to the multiplicity of cameras for forming a database of identities of each object.

Claim 29. The system of claim 28 wherein the multiplicity of cameras comprises at least two fixed volume tracking cameras with at least partially overlapping fields-of-view for detecting the motion of each marker in (X, Y, Z) space.

Claim 30. The system of claim 19 wherein the multiplicity of cameras forms an ever larger total field-of-view by adding additional sets of two or more fixed volume tracking cameras whose individual fields-of-view partially overlap each other covering new volume space and partially overlap existing cameras.

Claim 31. An automated system for first identifying and tracking multiple objects in an outer area that is adjoining a predefined area and subsequently tracking those objects as they enter and move about within the predefined area, the system comprising:

one or more energy sources emitting visible energy throughout both the outer and predefined areas;

one unique marker or set of markers adhered onto each object that reflects the visible energy;

a multiplicity of outer area cameras responsive to the visible energy reflected off the markers while the objects are within the outer area;

a multiplicity of predefined area cameras responsive to the visible energy reflected off the markers while the objects are within the predefined area;

a first algorithm operated on a computer system responsive to the outer area cameras for forming a database including the identity of each object as well as the object's changing location especially as the object enters the predefined area; and

a second algorithm operated on the computer system responsive to the predefined area cameras for updating the existing database of object identity and changing location from the outer area to include additional changing location information based upon the object movements in the predefined area.

Claim 32. The system of claim 31 wherein each multiplicity of cameras comprises at least two fixed volume tracking cameras with at least partially overlapping fields-of-view for detecting the motion of each marker in (X, Y, Z) space.

Claim 33. The system of claim 32 wherein each multiplicity of cameras forms an ever larger total field-of-view by adding additional sets of two or more fixed volume tracking cameras whose individual fields-of-view partially overlap each other covering new volume space and partially overlap existing cameras.